PCT/GB 99/01094 #3

The Patent Office

09/701057

INVESTOR IN PEOPLE

GB99/1094

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP9 1RH

REC'D 19 MAY 1999
WIPO PCT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Signed *[signature]*

Dated 4 May 1999

Patents Form 1/77

Patents Act 1977

The Patent Office

1/77

9
27MAY98 E363371-1 D03007
P01/7700 25.00 - 9811308.7

Request for grant of a Patent

The Patent Office

Cardiff Road
Newport
South Wales NP9 1RH
Switchboard
01633-814000

9811308.7

1.	Your reference	BEC/29431-00001-1
2.	Patent application number	
3.	Full name, address and postcode of the or each applicant Patents ADP Number If the applicant is a corporate body, give the country/state of incorporation	Spreckelsen McGeough Ltd Little Gawton Horsell Vale Woking Surrey GU21 4QU 07443047001 England & Wales
4.	Title of Invention	Fluid Packaging
5.	Name of agent Address for service in the United Kingdom to which all correspondence should be sent Patents ADP number *(if you know it)*	**FIELD FISHER WATERHOUSE** 41 Vine Street London EC3N 2AA 00873924001
6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and the or each application number	Country — Priority Application number — Date of filing
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and filing date of the earlier application	Number of earlier application — Date of filing
8.	Is a statement of inventorship and of right to grant of a patent required in support of this request?	Yes
9.	Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document Continuation sheets of this form Description Claims Abstract	 13 2 1

Drawing	4 d 4
10. If you are also filing any of the following, state how many against each item.	
Priority documents	N/A
Translations of priority documents	N/A
Statement of Inventorship	3
Request for search 9/77	1
Request for examination 10/77	1
Any other documents	Cover letter requesting combined search and examination
	We request the grant of a patent on the basis of this application
Signature	Field Fisher Waterhouse
Name	**FIELD FISHER WATERHOUSE** **Agent for the Applicant**
Date	26 May, 1998
Name and daytime telephone number of person to contact	Barbara E Cookson 0171 481 4841

SXD/SC/165

FLUID PACKAGING

The present invention relates to fluid packaging and, more particularly, to blow moulded plastics bottles for milk, which require to be filled and closed in a resealable manner.

In the specification which follows problems of packaging milk are specifically addressed. However, it will be appreciated that other pourable fluids such as fruit juices present similar packaging problems. The present invention is, however, only concerned with fluids which are not required to be packed in a gas-tight manner. Accordingly, the problems of packaging carbonated drinks are not addressed. The present invention is also specifically concerned with types of packaging where the weight of the container is an issue and therefore relates specifically to thin-walled blow-moulded bottles.

The Technical Background

Conventionally, milk has been packaged in cardboard, gable top packs which are notoriously difficult to open and result in numerous consumer complaints about milk spillage and difficulty in pouring. The fibre carton was only suitable for packaging liquids up to a capacity of 1.5 litres.

In order to resolve these problems blow moulded plastics polyethylene bottles have been used. These bottles are provided with resealable caps. The resealable caps are normally injection moulded items. There is a fundamental problem in achieving a good seal between a blow moulded bottle neck and an injection moulded plastics cap. This is because the tolerance of the neck is of the order of 0.3mm whereas the tolerance of an injection moulded item

such as the cap is 0.1mm. This means that a proportion of caps will not seal tightly when fitted to their necks. For all designs of caps this results in difficulties of fitting on the production line and, for retailers and distributors, leakage problems. The ultimate consumer may also have difficulty in resealing the bottle or opening it in the first place if the cap is over-tight.

A number of designs of injection moulded caps have been developed in an attempt to address these problems. For example, in a cap design known as a valve seal or pliable seal closure, a plug is provided in the cap which pushes into the neck of the bottle and a multiple start thread is provided on the interior wall of the cap skirt. This type of cap provides a double seal. The plug provides the seal against the inner wall of the neck. The second seal is provided by means of an inwardly projecting ridge above the threads on the inner wall of the cap which seals against the outer wall of the neck. Tamper evidence for this type of cap can be provided by a pliable pull away ring around the lower edge of the cap. With a cap made of low density polyethylene, it is possible to prise off the cap with the ring attached so that this form of tamper evidence is not very secure.

Another design known as the induction heat seal closure (IHS) provides a foil insert seated into the base of the cap. On the production line the filled bottles with caps fitted are passed through an induction heater which fuses the foil to the neck of the bottle. When the consumer unscrews the cap the neck of the bottle is still sealed by the foil. This foil seal is pulled off in a separate operation. Severing the seal results in small hairs being raised on the plastics surface of the bottle neck. The setting of parameters for the bonding process using

an induction heat seal closure is critical in order to achieve a bond which is weak enough to allow the consumer to be able to peel away the foil, yet strong enough to maintain a good primary seal with the container neck. Because the presence of the foil means that no plug can be provided the susceptibility to leakage in the consumer's home is increased as the resealing of the cap is poor. The cap is also relatively expensive as the provision of the foil insert can add as much as 20% to the cost.

Another set of problems arises from the production line process of filling the bottles and sealing them. Since the maximum linear speed of milk is restricted by the speed at which the milk starts to froth, the rate of filling depends upon the size of the nozzle used to pour the milk into the bottles. The nozzle size is constrained by the dimensions of the neck. For a typical milk container this is 38mm. Larger necks allow for quicker filling but present greater sealing problems and require larger caps.

In many modern production lines, the blow moulding plant is adjacent the dairy. This allows the bottles to be formed, filled and sealed in a single continuous production process. The most complex stage in blow moulding is balancing each parison and controlling the material distribution. The parison is then inflated against the wall of a temperature regulated mould solidifying to assume the shape of the mould cavity. In one conventional design of blow moulding machine a block of moulds shuttles between an extrusion station and a blowing station. The number of die-heads provided is generally equal to the number of cavities in the block or some fraction thereof. These die-heads are fed by a head

manifold which typically results in an imbalance in the delivery of plastics material to each of the resulting parisons. This process results in difficulties in forming consistently the neck-portion of thin walled containers, achieving at best tolerances of +/- 0.3 mm with repeatable accuracy. To achieve good performance with valve seal closures, it is imperative to form a perfectly round neck-bore with a minimum amount of ovality in both bore and threaded portion. Two processes are known to achieve the above result in multi-cavity blow moulding. They are namely a "pull-up" process, which is the lifting of a blow pin through a shear-steel assembly to cut a round bore in a bottle neck, or a "ram-down" process, which is the forcing downwards of a blow pin into a shear steel assembly. The drawback with pull-up is that the neck component is physically weak in its construction leading to poor sealing with valve seal closures as the bore relaxes over time causing leakage. Ram-down however, gives a very rigid neck but this has a weight disadvantage causing ovality of the neck coupled with added cost of material wastage. Ovality causes poor sealing with valve seal closures. Neither of these two processes are suitable for moulding pour-lip features on bottle-necks. With the pull-up finish it is almost impossible to mould and with the ram-down it requires significant amounts of extra material and is almost impossible to mould without significant ovality and imperfections in the bore.

The above processes described relate to moulding machinery manufactured by companies such as Uniloy, Techne and Bekum, for example.

An alternative type of machine made by Graham Engineering and Uniloy, which is particularly suitable for on-site

blow moulding plants, uses a process which is commonly referred to as wheel blow moulding. Unlike the previous processes described, the wheel produces only one parison at a time extruded from a single die-head. The mould blocks are mounted on a rotary wheel structure and pass over the parison closing as the wheel rotates. A needle assembly pierces the parison and inflates the plastic until it solidifies against the wall of the temperature regulated moulds. Wheel blow moulding gives a high level of control in material distribution in containers produced in this way. The set up time for such a machine is significantly reduced as only one die-heads needs to be set up.

Where the inner wall of the neck provides one part of a seal, it may be necessary to provide a separate finishing station where the neck is either reamed or punch finished. The finishing step may produce swarf which results in the risk that the swarf could enter inside the bottles and make them unsuitable for immediate filling.

For products such as milk where large quantities are required to be distributed through the retail chain, it is highly desirable to minimise the weight of the packaging. This has resulted in larger containers and thinner walls. Typical wall thicknesses for blow moulded high density polyethylene (HDPE) are 0.4 to 0.6mm. This results in a 4 pint (2.27 litres) bottle having a weight of around 40 grams. Therefore any solution to the technical problems described must not increase the weight of the bottle and preferably would allow weight reduction.

Prior Art

For thin walled blow-moulded plastics bottles for milk the teaching has hitherto been directed exclusively at integral formation of the bottle body and neck.

For cardboard cartons it has been proposed to provide a separate spout assembly which is secured to the carton. An example is described in WO-A 96/14249 (Capitol Spouts Inc). This spout includes a cap and an integral inner membrane seal and is assembled to an outer wall of a filled carton. The container may have a scored portion so that when the inner membrane seal is removed it brings with it the scored portion of the container wall creating an opening through which the contents of the container can reach the spout. This assembly is not suitable for use with a plastics container where it would be impractical for the user to tear an opening in a plastics walled container. Although this document is referred to as the most relevant prior art it does not represent a natural starting point for those seeking to solve the technical problems described in relation to a thin - walled plastics bottle as its teaching is exclusively concerned with a container such as a cardboard carton with a continuous inner lining.

Solution of the Invention

In order to solve the technical problems discussed above, the invention as set out in the appended claims is proposed. In accordance with the invention a thin - walled plastics bottle is formed from a blow moulded body and a preferably injection moulded neck and cap assembly which can be fused together after the body has been filled with a fluid.

This solution has numerous advantages. The neck and cap will fit together in a reliable sealing manner as both components are formed by the same manufacturing technique, preferably injection moulding. The neck and cap assembly can be supplied from a separate factory which can produce them in hygienic circumstances. Any of the pre-existing cap designs can be employed.

The body to which the neck and cap assembly is fitted can have a relatively wide mouth through which it can be filled, thus increasing the filling speed.

In addition, a foil can be used to seal the mouth at the same time as the neck and cap assembly is fused to the mouth in a single heat sealing operation. This results in more reliable sealing of the filled bottles avoiding any leakage during the distribution and retailing cycle.

The term thin-walled as used herein is intended to refer to wall thicknesses of 2mm or less and preferably within the range 0.1mm to 1.0 mm. A container having a wall thickness of less than 0.1mm is unlikely to have the necessary structural integrity to hold its shape when filled with fluid. For a milk container of up to 6 pints (3.41 litres) capacity a thickness of 0.4 to 0.6mm is appropriate.

Description of a Preferred Embodiment

In order that the invention may be well understood an embodiment thereof will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a side view of a mouth of a bottle body;

Figure 2 shows a perspective view of a mouth of a bottle body;

Figure 3 shows a top plan view of a mouth of a bottle body;

Figure 4 shows a section through a side wall at a mouth of a bottle body;

Figure 5 shows an exploded view of a neck and the bottle body;

Figure 6 shows a section through the assembled neck and bottle body;

Figure 7 shows a section through an alternative design detail of the junction of the neck and bottle body;

Figure 8 shows an exploded view of a neck and cap assembly and the bottle body;

Figure 9 shows a section through a detail of the junction of the neck and cap assembly and the bottle body;

Figure 10 shows a diagram illustrates the process for, attaching a foil to the neck and cap assembly;

A bottle body 2 has a mouth 4 which is integrally formed in a single blow moulding operation. The remainder of the body shape has not been shown as it may take any suitable form. For example it may be square, rectangular or round in section and may have an integral handle formed as part of the body shape.

The profile 6 of the mouth is best shown in Figure 4 and comprises a vertical wall 8 adjoining an indented recess

10 which merges into an inwardly directed horizontal seating flange 12. The purpose of the recess 10 is to give the mouth profile more rigidity and resistance to compression when top loaded during the subsequent operations to attach a neck and cap assembly. It is also used to locate a mouth of the neck assembly when applied in the filling process.

The body 2 with its shaped mouth profile 6 is formed by the mould against which a parison of high density polyethylene or other suitable plastics is inflated in any appropriate conventional blow-moulding operation. If the blow moulding takes place on a rotary machine then nicks 14 in the flange 12 as shown in Figure 3 will be formed. These are usually removed in second stage trimming by either reaming or punching after any dome of the parison guillotined from the container to leave the open mouth 6. This invention removes the necessity for this trimming and finishing. It is not necessary to remove these or any other irregularities in the internal profile of the mouth for use in the fusing of the neck to the container profile 6.

A neck assembly 16 is shown in Figures 5 and 6. The neck comprises an annular side wall 18 with an integral base 20. A skirt 21 extends around the exterior of the wall 18 adjacent the base 20 and is inwardly curved in order to engage with a profile 6. In an alternative embodiment the annular wall 18 could be provided with a shoulder so that a mouth 22 of the neck which is closed by a cap (not shown in Figs 5 and 6) may be of smaller diameter than the mouth of the body.

The mouth 22 is provided with an indentation 24 surrounding the outer surface of the neck and an

outwardly projecting flange 26. This construction is designed to co-operate with a cap used to close the neck. The profile of the neck may readily be adapted for use with any existing plastics caps and may have a thread or multi-start threads formed in the outer surface to engage with a screw thread formed in an inner wall of a co-operating cap.

The base 20 has a pull out section 26 separated from the remainder of the base 20 by a frangible portion 28 which provides a circular line of weakness in the base. An integral pull tab 30 is also provided as part of the pull out section 26 of the base.

An alternative design of the base is shown in Figure 7. Here the base is an annular flange 32 which does not extend across the entire mouth of the body. A circular frangible portion 32 is provided with a pull tab 36 to allow an inner ring to be pulled out.

In both embodiments of the neck, the cap is assembled to the body with an intermediate sealing foil 40. The foil 40 may be a polymer foil or a polymer foil laminated to an aluminium foil or aluminium. Any of the materials traditionally used for providing a heat-seal foil in existing plastics milk bottles may be employed. Where an aluminium laminate is used small perforations may be provided in the aluminium layer to allow the polymer to pass through during the heat sealing process and thereby form a bond between the flange 12 of the bottle body and the adjacent surface of the base 20 of the neck. The foil 40 is preferably supplied already bonded to the mouth of the neck and cap assembly.

Figure 10 illustrates a process for forming and sealing a foil 40 to complete the neck and cap assembly.

In Figure 8 an exploded view of all the components of the bottle including the body and neck and cap assembly are shown. A cap 42 as illustrated in Figures 8 and 9 has an internal plug formed by a downwardly depending flange 44. The plug seals against an inner edge of the flange 26 of the neck. At an outer edge of the cap 42 a shorter flange 46 depends and terminates in a bead 48 which snap fits underneath the flange 26 to form a second external seal. The opening of the neck is closed by a flat circular plate 50 of the cap from which the flanges 44 and 46 depend.

After the neck 16 and cap 42 have been injection moulded and assembled, an aluminium foil/laminate foil 40 is punched out from a web of material. Each foil 40 has a diameter larger than the base 20 and has a saw-tooth shaped outer profile. The web is pre-punched to provide a series of foil profiles 40 loosely connected to a remainder of the web with bridges 54 which can easily be broken to insert the foil into the neck component 16. The foil will also be pre-scored with indentations 56 which will later align with the frangible portion 28 to facilitate ease of removal. The foil profile 40 is punched from the web 58 and located in the neck component 16 by a mandrel 60. The assembly is placed in an induction heater which fuses the foil 40 to a mouth of the neck 16.

Both the neck and cap are preferably injection moulded plastics components. Since they are both manufactured by the same method to the same tolerances the seal between neck and cap will be good. The neck and cap assemblies may by supplied to a bottling plant ready assembled, tested and sterilised.

Filling Process

The described bottle and neck and cap assemblies may be used in various ways in bottling plants. The bottle bodies may be supplied to the plant ready formed but this results in the need to transport large volumes and it is preferable to form the bodies in a blow moulding plant adjacent the dairy so that they can be formed and filled in one continuous production line. The absence of any requirement for further trimming and finishing the interior of the mouth of the body makes this design of bottle particularly suitable for such a process.

The bodies are filled through the mouth with the fluid such as milk.

In aseptic packaging the foil 40 will be sprayed with a sterilising solution such as a water/paracetic acid mixture in order to sterilise the face of the foil which will be adjacent the milk in the finished container. Such a sterilising solution is marketed under the trademark OXONIA. Alternative sterilising methods such as irradiation may be employed but are at this time more expensive.

The sterilised and foiled neck and cap assemblies are supplied through a chute to a pick and place mechanism, which orients each neck and cap assembly and places it on a filled bottle body. The skirt 21 clips over the profile 6 capturing the edges of the foil 40 between the two components. The saw-tooth circumferential edge of the profile prevents unnecessary folding of the foil which otherwise might impair sealing performance. In the next step, the neck assembly 16 is bonded to the body 12. Preferably a chute of the pick and place mechanism contains an induction coil so that as each assembly is

pressed onto the body induction heating is applied to bond the foil to the body. To form an effective bond some pressure may be required to hold the body and neck firmly together during this step. The induction heating and bonding may alternatively be carried out at a separate station downstream of the pick and place mechanism. Suitable induction heating machines are supplied by ENERCON AHLBRANDT. Rotation generated friction heating could also be used to fuse the body and neck and cap assembly.

CLAIMS

1. A thin - walled plastics bottle comprising a blow moulded body and a neck and cap assembly adapted to be fused together after the body has been filled with a fluid.

2. A neck and cap assembly comprising a base adapted to be fitted to a corresponding mouth at the top of the body, said base being covered by a heat sealable foil.

3. A neck and cap assembly as claimed in claim 1 or 2, wherein the base contains a frangible portion and means to enable the user to remove a section defined by the frangible portion.

4. A neck and cap assembly as claimed in claim 1, 2 or 3, wherein the components thereof are formed from injection moulded plastics material.

5. A process for bottling fluid comprising the steps of:

   blow moulding bottle bodies having open mouths;

   filling said bottle bodies;

   fitting a neck and cap assembly having a base of the neck sized to correspond to the open mouth of the bottle body to each filled bottle body;

   heat sealing the bottle bodies to the neck and cap assemblies.

6. A process as claimed in claim 5, wherein a sterilised foil is interposed between the mouth and the base of the neck.

7. A process as claimed in claim 5 or 6, wherein the fluid is milk.

8. A process as claimed in claim 5, 6 or 7, wherein the bottle bodies are blow moulded using a rotary machine having a series of moulds adapted to pass beneath a single die-head for the supply of a predetermined amount of plastics material to form a parison which is subsequently inflated to form said body.

9. A process as claimed in claim 8 wherein the bottle body leaving the mould is passed directly to a filling station.

10. A bottle substantially as herein described with reference to the accompanying drawings.

11. A process for bottling fluids substantially as herein described with reference to the accompanying drawings.

ABSTRACT

FLUID PACKAGING

A bottle is formed from a blow moulded plastics body and an injection moulded neck and cap assembly which can be fused to the body after the body has been filled with a fluid. The body may be provided with a relatively wide mouth to enhance the filling speed. The bottle is particularly suitable for blow moulding in a plant adjacent to a diary where it will be subsequently filled with a fluid and fused to a pre-sealed neck and cap assembly in a single continuous operation.

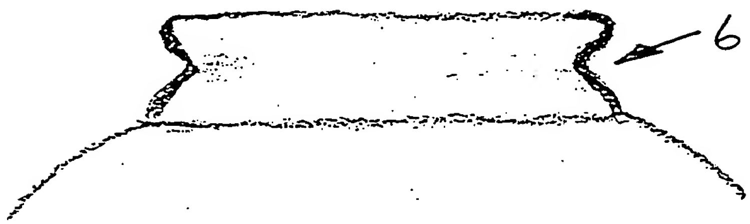

FIG 1

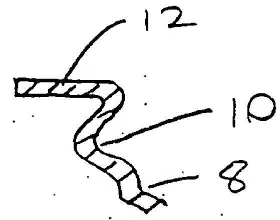

FIG 4

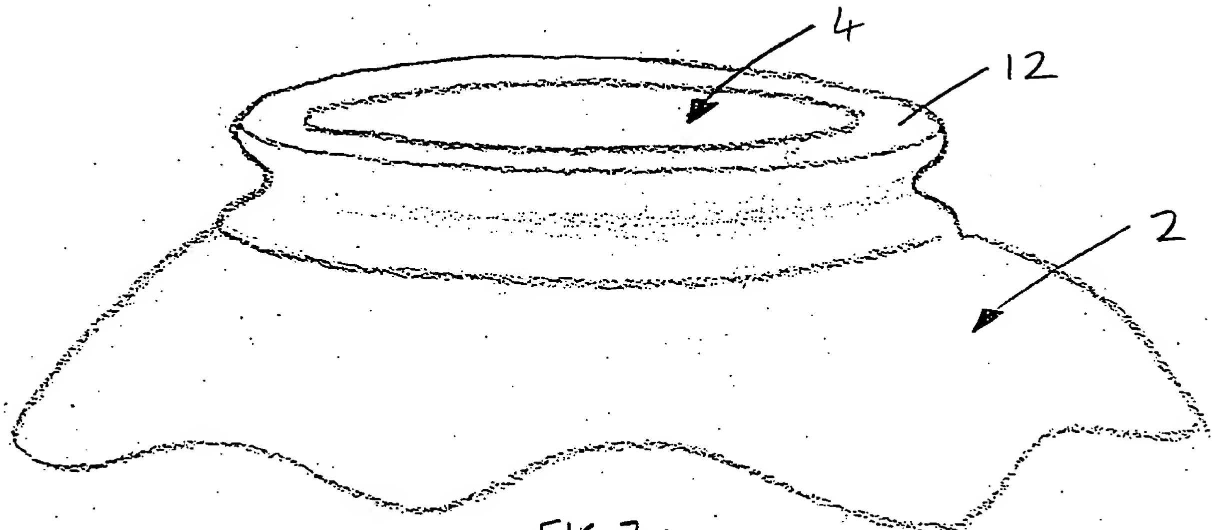

FIG 2

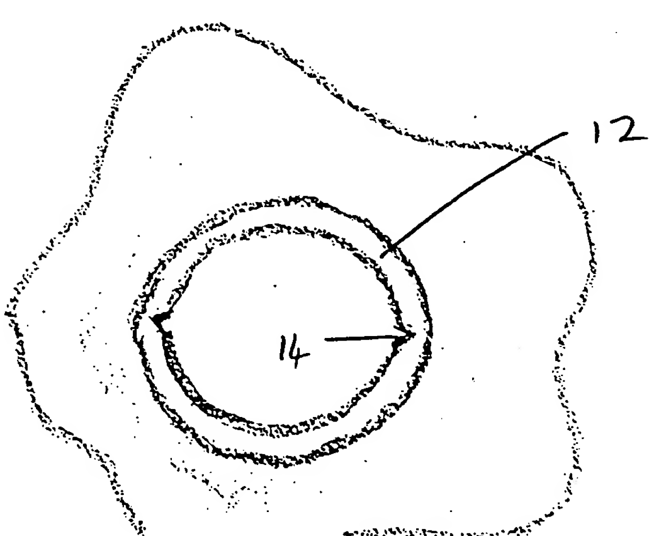

FIG 3

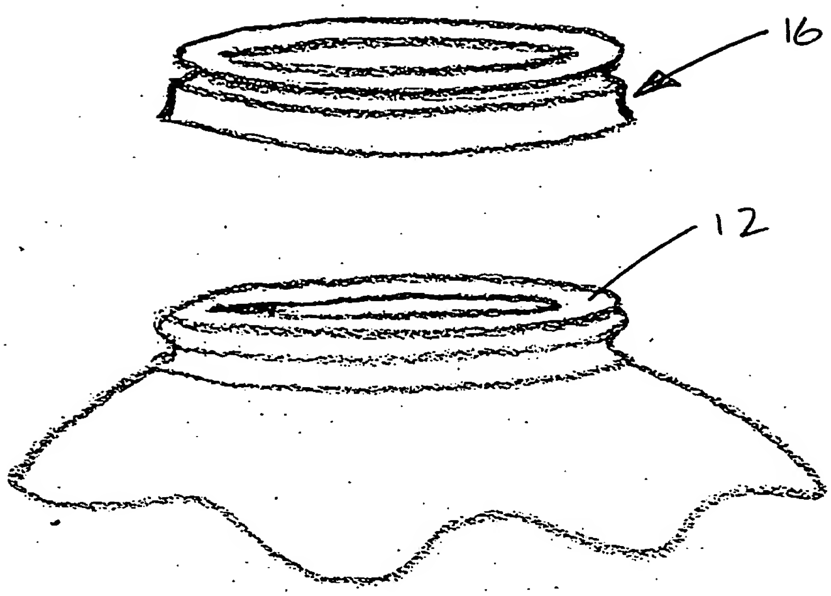

FIG 5

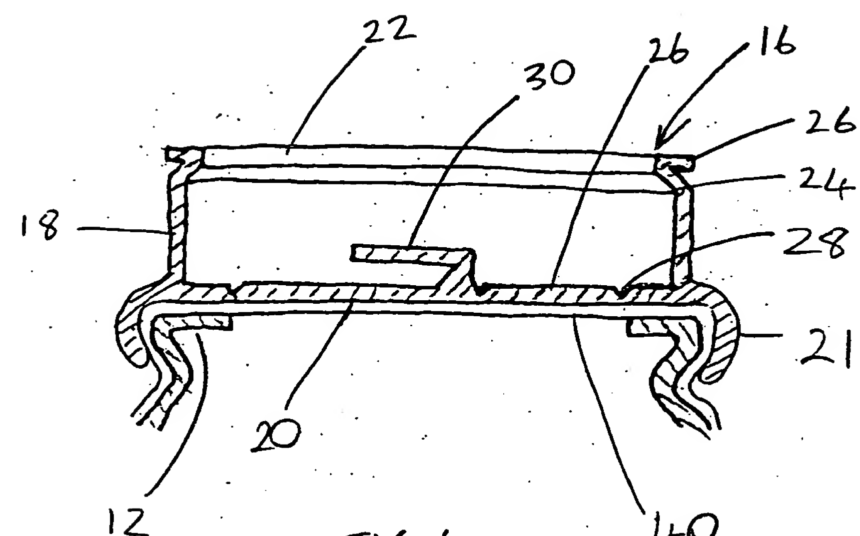

FIG 6

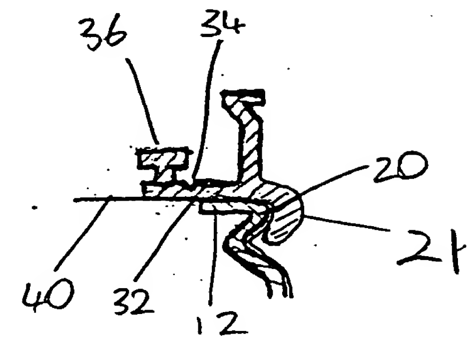

FIG 7

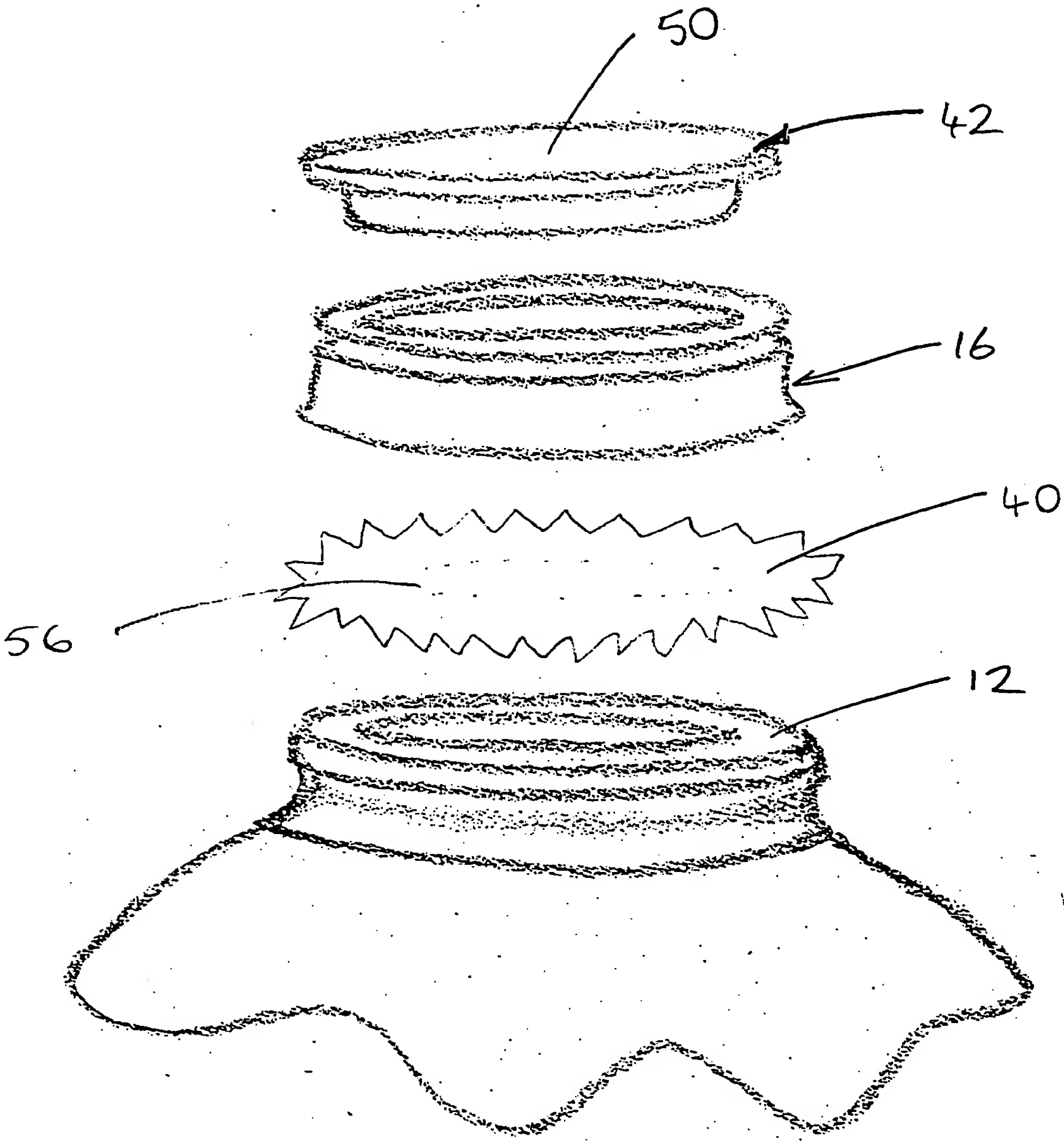

FIG 8

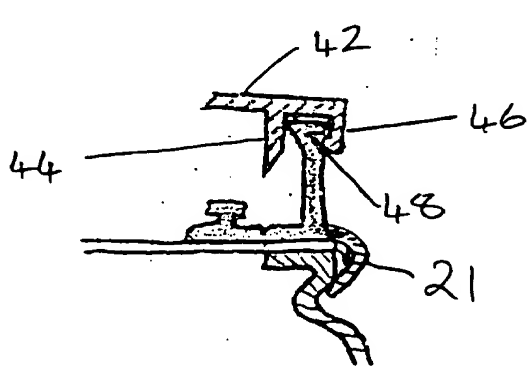

FIG 9

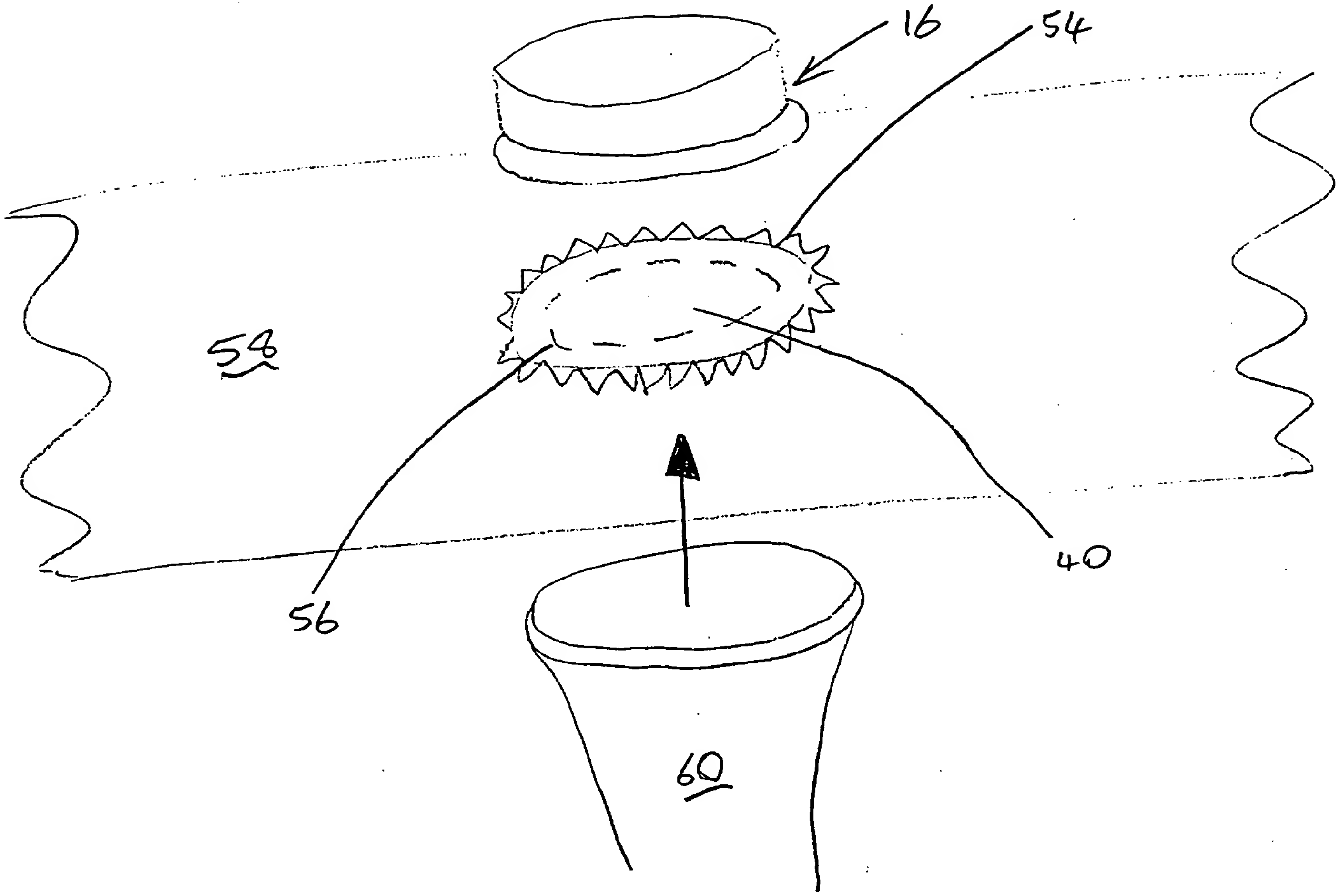

FIG.10